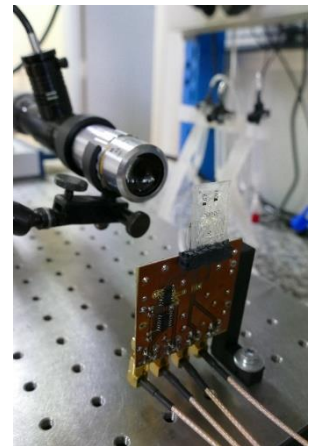




PhD proposal 2018-2021 Microrobotic for cell sorting

Context:

The treatment of a huge number of diseases, including cancers, is tightly related to our capacity of understanding and harnessing the development of cell populations. Cell characterization and cell sorting are thus tremendous challenges for therapies of the future. These last years, significant progress have been made, especially due to the development of lab on chip devices. These devices are composed of micro fluidic channels and include several detection and characterization stages to perform cell characterization and cell sorting.



The micro mechatronic (AS2M) department of the FEMTO-ST Institute aims to develop lab on chip for highly selective cell sorting based on robotic approaches. Its goal is to propose the next generation of automated cell sorters in the framework of immunotherapy. Immunotherapy is a highly innovating technique based on optimizing the immune response of the patients. Impressive results have been obtained on people suffering from cancers. This highly personalized technique consists in isolating the rare lymphocytes of the patient presenting anti-tumor activity, duplicating them by cell culture, and administering the cloned lymphocytes to the patient. However, in most cases, this treatment must face a major challenge: the identification of these rare natural lymphocytes having a concentration lower than 0.1%, which is beyond the detection level of current techniques.

Objectives of the thesis:

The objective of this work is to improve the selectivity of the current cell sorters by developing the next generation of lab on chip based on robotics. The candidate will integrate actuators and sensors in the chip to perform real time closed loop control. The actuators (gold electrodes deposited at the bottom of the channels) will be used to control the trajectory of the cells by applying a dielectrophoretic force generated by time varying electric fields. The candidate will develop an original position sensor based on impedance spectroscopy approaches to monitor in real time the position of the cells in the channels. He/she will propose a model of the system suitable for real time control and he/she will implement closed loop control laws to guaranty the precision of the cell positioning despite all the perturbations to reach highly selective cell sorting.



Working environment:

This work will be led in the FEMTO-ST Institute, which is a CNRS research laboratory linked to the Université de Franche-Comté, the microtechniques engineering school (Ecole Nationale Supérieure de Mécanique et de Microtechniques), and the Université de Technologie de Belfort-Montbéliard. Around 700 people are working in 7 research departments, among which the micro mechatronic (AS2M) department will host the candidate. The candidate will get access to all the scientific equipment, including Finite Element Modeling software, micromanipulation platforms, 1300 m² of clean room facilities, etc. He/she will get the opportunity to present his/her work in international conferences and journals and get the funding to buy all equipment required for this work.

This thesis is part of the joint french-swiss ANR project CoDiCell (<http://projects.femto-st.fr/CoDiCell/>). Partners of the project are: CNRS (France), EFS (French Blood Agency) and EPFL (Ecole Polytechnique Fédérale de Lausanne, Switzerland). The candidate will work in close collaboration with people from these three institutions.

Applications:

Required skills: we are seeking a talented and enthusiastic student to perform a PhD in microrobotics. The candidate should have a strong background in mechatronics, robotics, control and/or programming (C++, Matlab) and interest for applied physics. The candidate should have good command of spoken and written English. No specific background is required in dielectrophoresis or biology.

To apply, send a Curriculum Vita, a motivation letter and if available the master grades to: aude.bolopion@femto-st.fr

Contact:

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